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Surgical management and functional outcome of Galeazzi fracture dislocation

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Abstract
Galeazzi fracture is a condition where there is distal radial shaft fracture associated with disruption of the distal radioulnar joint. Although Galeazzi fracture patterns are uncommon, they are estimated to account for about 3% of all forearm fractures in children and about 7% in adults and are seen most often in males. The present study was conducted on n=25 subjects of which n=2 were children and n=23 adults with classic Galaezzi lesions in the Department of Orthopaedics, Jagadguru Jayadeva Murugarajendra Medical College, Davangere, Karanataka, India, who attended the outpatient or the emergency service of Bapuji Hospital and Chigateria Genral Hospital, Davangere, Karanataka, India**.** Twenty three patients were treated by dynamic compression plate and intramedullary nail in adults and conservatively with closed reduction in children (n=2). Majority of the patients were in the age group of 20-30 years with mean age 26.32 years and majority were males in the ratio of 4:1. The functional outcome results at follow up were assessed according to Mikic's criteria and rated as excellent, fair and poor. In this study the functional outcome results in children's (n=2) group, in n=2 excellent results were achieved. Out of n=23 adult patients, n=21 had excellent result, n=1 fair and n=1 had poor result. This study showed that Galeazzi fracture patients treated with dynamic compression plate and intramedullary nail in adults had excellent functional outcome results in adults.

Keywords: Distal radioulnar joint, functional outcome, Galeazzi fracture-dislocation

Introduction
The Galeazzi [1] fracture is an unstable fracture-dislocation of the forearm associated with a fracture of the shaft of the radius and a dislocation of the distal radio-ulnar joint (DRUJ) and bilateral Galeazzi fracture dislocations are rare [2, 3]. This fracture is also eponymically referred to as a reverse Monteggia fracture [4], a Darrach-Hughston-Milch fracture [5]. Campbell [6] termed it as a "fracture of necessity," because it necessitates surgical treatment; in adults, nonsurgical treatment of the injury results in persistent or recurrent dislocations of the distal ulna.

Although Galeazzi fracture patterns are reportedly uncommon, they are estimated to account for about 3% of all forearm fractures in children and about 7% in adults [7]. They were seen most often in males. Direct or indirect trauma to the wrist can lead to Galeazzi fractures. The mechanism of injury typically is a force applied on the dorsolateral aspect of the forearm, or a fall with forearm pronation onto an outstretched hand. Patients may present with pain around the mid-forearm and wrist. This lesion is characterized by its unstable nature and there is the need for open reduction and internal fixation to achieve a satisfactory functional outcome. A thorough examination for instability of the DRUJ must be conducted by the surgeon.

Successful treatment of Galeazzi fractures depends on the reduction of the radius and DRUJ and the restoration of the forearm axis. Hughston [8] outlined the difficulties and complications of non-operative treatment. An unsatisfactory result caused by a loss of reduction, that in turn, led to mal-union was identified in 92% of the patients treated with closed reduction and cast immobilization.

The incidence of non-union of Galeazzi fractures is very low. The rate of union following the open reduction of forearm fractures has been reported in 98% [9] cases. Reckling [10] and Moore *et al*. [11] separately reported satisfactory results with compression plating and immobilization in supination. The management of Galeazzi fractures in adults in our series is operation in the form of open reduction and compression plating of the radius [12].

With advances in the surgical techniques to achieve osteosynthesis and soft tissue reconstruction, open reduction and internal fixation (ORIF) has become the standard of care to optimize outcomes after the forearm fractures associated with DRUJ disruption. Surgical management has yielded satisfactory results in more than 80% of adult patients with these injuries.

Various authors have stated that surgery is the line of treatment for Galaezzi fracture dislocation hence, we opted operative treatment by dynamic compression plate and intramedullary nail for classic Galaezzi lesions in adults and conservative management in children. In the present study of n=25 patients, n=2 were children (up to 16 years old) and n=23 adults with classic Galaezzi fracture dislocation.

The chances for the occurrence of mal-union, non-union and cross union are greater because of the difficulties in reducing and maintaining the reduction of two parallel bones in the presence of the pronating and supinating muscles, which have angulatory as well as rotatory influences that cannot be eliminated, which frequently displace the fractures after a satisfactory reduction.

There are a number of complications of unsatisfactorily treated Galeazzi fracture dislocations. These include DRUJ instability, mal-union, restricted range of motion at wrist, chronic wrist pain, and osteoarthritis of the wrist joint [4].

The present study was undertaken to study the incidence of Galaezzi fracture dislocation and evaluate functional outcome results after surgical treatment of Galaezzi fracture with various modalities in children as well as adults.

Material and Methods

The present study consisting of n=25 subjects of which n=2 cases were children and n=23 adults with classic Galaezzi lesions was conducted in the Department of Orthopaedics, Jagadguru Jayadeva Murugarajendra (JJM) Medical College, Davangere, Karanataka, India, who attended the outpatient or the emergency service of Bapuji Hospital and Chigateria General Hospital, Davangere, Karanataka, India**.** The age of the subjects ranged between 9 – 55 years. There were n=22 male and n=3 female subjects treated at Chigateri General Hospital and Bapuji Hospital, Davangere, Karanataka. This study comprised of 2 male (n=2) children (up to 9-16 years) with Galaezzi fracture.

All the patients were examined thoroughly for their general condition, and associated injuries. All the findings were duly recorded in the patient proforma. The patients were subjected to clinical and radiographic examination. All the patients were radiographically proven Galeazzi fracture dislocation. The inclusion criteria of the study was: 1) Patients having radiographically confirmed Galeazzi fracture, 2) Closed fracture, 3) Open fractures not above Gustilo Anderson grade I, 4) No pre-existing arthrosis of the wrist, 5) No pre-existing fracture around the wrist on the epsilateral side. Likewise, exclusion criteria included: distal radius fracture without radiographical DRUJ subluxation/dislocation, open fractures, pre-existing fracture around the wrist or arthrosis of the wrist. Ethical Committee approval was taken from the College Ethical Committee Board.

After obtaining written informed consent for surgery the patients were operated. Operative treatment was done as an elective procedure for all the cases who attended outpatient department with lesion. Cases were taken up for the study irrespective of the duration of fall.

In this series, out of n=25 cases, n=2 cases were children and n=23 young adults and adults. We have advocated conservative line of treatment in only stable injuries which were in children and n=2 were treated conservatively with closed reduction. Elective open reduction and internal fixation was done in n=23 cases, of which n=20 cases with dynamic compression plate and n=3 cases 1/3 semi tubular plate done without trial of close reduction, 2 cases with conservative method. The distal radio ulnar joint was always reduced. All fractures were operated under tourniquet.

Both dorsal and volar operative, wither Henry or Thompson's approaches were used. The plates were applied sub periosteally but the insertion of pronator teres and pronator quadratus were not disturbed, in n=2 (8%) cases primary bone grafting was used. Stability of distal radioulnar joint was determined during operation by manipulating and palpation after the radius has been plated. Post-operatively the extremity was immobilised for 3-4 weeks in the above elbow plaster cast which is maintained in neutral position or in mild supination. No functional bracing was used.

The operative findings, immediate post-surgical results and complications were documented. External immobilization was given to all cases for 6 weeks. Further follow up was done from 3 months to one year. Clinical, radiological and subjective analysis was done when they visited the hospital.

The follow up criteria for analyzing the functional outcome results was both subjective and objective. The subjective analysis was the opinion from patients and objective analysis depended upon range of movements and pain around the inferior radio-ulnar joint and deformity. The healing process time and reduction of head of ulna was also taken into evaluation. Radiographs were evaluated for healing of the fracture, alignment of the radius and reduction and congruity of the surfaces of the distal radio ulnar joint. Healing was rated as excellent if there was solid union with less than 5º of angulation of 5mm, shortening of the radius and was considered poor if there was no union or angulation or shortening that exceeded those values.

Results and Discussion

In the present study, the characteristics of the study group subjects (n=25) are presented in the Table 1. The lesion was more common in adults and young adults. The age of the subjects was in the range 9 - 55 years. Majority of patients were in the age group 20-30 years with mean age 26.32 years.

Classic Galaezzi injuries have been described in children while in the current study they occurred more frequently in adults. In this study of n=25 cases, majority n=22 (88%) of the male cases were affected than females n=3 (12%), similar to the earlier studies of Dewo *et al*. [13]. This again reflects that outdoor activity and occupation which are responsible for higher incidence of this lesion in males who are engaged in earning. This is confirmative with other documented series.

Table 1: The characteristics of the subjects (n=25) in this study.

Characteristics		n=	(%)
Sex	Male	22	88
	Female	3	12
Age	10-20	2	8
	21-40	18	72
	41-60	5	20
Side	Right	18	72
	Left	7	28
Mechanism of injury	Road traffic accident	12	48
	Direct (self)	5	20
	Sports	3	12
	Industry	1	4
	Others	4	16

In the present series, the results of occupational incidence of injury (Table 2 and Fig. 1) found that the lesion was more common in manual labour n=8 (32%), followed by farmers n=5 (20%), professionals n=4 (16%), later by students n=3 (12%) and businessmen n=3 (12%) and least in house wives n=2 (8%) and are in confirmative with other documented series. Right n=18 (72%) side was more commonly affected than left n=7 (28%) side (Table 1).

In the present series, mode of injury in majority n=12 (48%) cases was due road traffic accident (RTA). Direct injuries to the forearm by assault was in n=5 (20%) cases, and indirect by fall on outstretched hand was in n=4 (16%) cases, remaining subjects had different types of injury which included sports in n=3 (12%) and industry n=1 (4%) subject (Fig 1).

Table 2: Distribution of the subjects (n=25) based on the occupational incidence.

Subjects (n=)	Manual labour	Farmers	House wives	Students	Business men	Professionals
	8	5	2	3	3	4
(%)	32	20	8	12	12	16

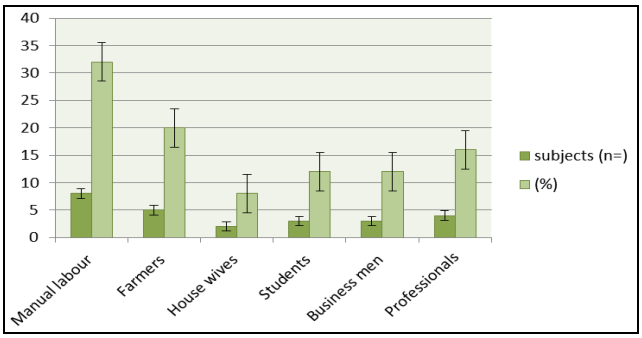

Fig 1: Distribution of the subjects (n=25) based on the occupational incidence.

In this study, the based on type of fracture n=17 (68%) were transverse, n=5 (20%) cases oblique, n=2 (8%) were comminuted fractures and n=1 (4%) sub periosteal, contradictory to the study made by Mikic [14].

Duration between the injury and first appearance for the treatment varied from 1 day to 1 month. The majority of the cases were presented with ventral angulation with depression over the lateral aspect of forearm. 23 (n=23) patients reported to the hospital within 2 weeks of injury and the remaining n=2 cases reported 1 month after the injury. Majority of the patients were presented with ventral angulation and depression over the lateral aspect of the forearm, shortening of radius was a constant sign. Abnormal mobility and crepitus could be elicited in all adult patients.

4 (16%) cases were associated with other fractures like upper 1/3 tibia fracture; fracture scapula, fracture acromian process, fracture coronoid process. On radiological evaluation, we have noted n=5 (20%) cases with oblique type, n=17 (68%) cases with transverse, n=2 (8%) cases with comminuted, subperiosteal fracture with angulation in n=1 (4%) case and spiral in NIL cases. Our results are similar to the findings of the studies made by Mikic [14].

In this series we have classified Galeazzi fractures radiologically on the basis of Chattopadhyay and Chatterjee [15] into two types. n=20 patients belong to Type A fracture with fracture line passing from above downwards and laterally whereas, n=3 cases to Type B with fracture line passing from above downwards and medially.

Regarding dislocation of ulna, two types have been identified according to Chattopadhyay and Chatterjee [15]. In Type A fracture n=15 cases had dorsal dislocation and n=6 cases had volar dislocation. In Type B, n=2 cases had dorsal dislocation and n=1 case had volar dislocation. Fracture or avulsion of ulnar styloid process is fairly common and is considered as equivalent to rupture of triangular fibrocartilage.

The results at follow up were assessed according to Mikic's [14] criteria. The functional outcome results were graded as good, fair and poor (Table 3). The results were graded as good in which there was good union, perfect alignment, no loss of radial length, no subluxation of distal radio ulnar joint, no limitation of elbow and wrist function and no limitation of supination or pronation. The outcome was graded as fair result in which there was one or more of the following: delayed union, minimum mal-alignment and shortening of the radius, subluxation of ulnar head, excessive scar formation, minimal restriction of supination and pronation up to 45º and some degrees of restriction of motion at elbow and wrist. The results were rated poor if there was one or more of the following such as pain, deformity of forearm, mal-union / nonunion, remarkable shortening or angulation of the radius, dislocation of distal ulnar joint, gross limitation of supination and pronation by more than 45º and excessive restriction of elbow and wrist function.

In this study, out of n=23 cases, n=21 subjects had good functional outcome results (Table 3, Fig. 2), n=1 had fair and n=1 subject had poor result. Out of n=2 subjects in the group of children two cases were treated conservatively, in which adequate stable reduction was easily achieved by manipulation probably because the fracture was subperiosteal. In these n=2 cases the functional outcome result was good.

Table 3: Functional outcome results of the treatment of Galaezzi fracture as per Mikic criteria.

Results	Adults n= (%)	Children n= (%)	Total n= (%)
Good	21 (91.4)	2 (100)	23 (92.0)
Fair	1 (4.3)	-	1 (4.0)
Poor	1 (4.3)	-	1 (4.0)
Total	23 (100)	2 (100)	25 (100)

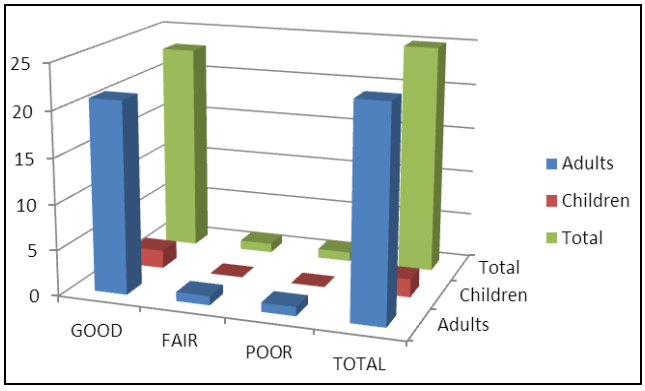

Fig 2: Functional outcome results of the study subjects

Plating was done on volar in n=18 cases and dorsal in n=5 cases. The results were analysed separately. In dorsal n=5 (21.7%) cases the functional outcome results were good. In volar plating functional outcome was good (Fig. 3A-D) in n=16 (69.7%) cases, fair in n=1 (4.3%) case, poor in n=1 (4.3%) case.

The results were analysed separately for dominant and non-dominant hand, in which dominant hand had good outcome results in n=17 (68%) cases, fair in n=1 (4%) case. Non-dominant hand had good outcome results in n=6 (24%) cases, fair in no case and poor in n=1 (4%) case.

In this series, Galaezzi fractures in adults were classified into 2 types according to Chattopadhyay and Chatterjee [15]. In this series, n=21 (87.5%) cases were of Type A and n=3 (12.5%) cases of Type B. The results in Type A were good in n=20 (83.3%) cases, fair results in no case, poor in n=1 (4.2%) case. In Type B, good results were achieved in n=2 (8.3%) cases, fair in n=1 (4.2%) case and poor in no case.

Fig 3: A- pre-operative X-Ray, B- post-operative X-Ray, C- X-Ray at 3 months, D- good union after 6 months.

Discussion

Comparative analysis of the functional outcome results of our study with the previous studies is summarized in Table 4. Our results of functional outcome of surgical management are comparable with the outcome results of Mikic **[14]**, Dodge and Cady **[16]**, Strehle and Gerber **[17]** and Mohan *et al* **[18]** (Table 4).

Table 4: Comparative analysis with the previous studies.

Author	Adult patients	Osteosynthesis	Results		
			Excellent /Good	Fair	Poor
Mikic [14]	13	Plating	6*	4	2
Dodge & Cady [16]	21	Plating	19	-	2
Strehle & Gerber [17]	19	Plating	16	3	-
Mohan *et al*. [18]	11	Nailing	4	7	-
	29	Plating	28	-	1
Present series	23	Plating	21	1	1

E/G = Excellent to good, F = Fair, P = Poor, *= Data unavailable for 1 patient

Plating of the fracture of the radius is most suitable in these cases and if correctly done it provides rigid internal fixation of the bone and stable reduction of the DRUJ in most cases **[1, 18]**.

- Clinical and radiographic diagnostic criteria for a Galaezzi fracture dislocation were not well established. Pain and swelling in the region of distal radioulnar joint do not distinguish the disruption of the triangular ligament complex from a severe sprain or contusion. Dorsal prominence of ulnar head is suggestive of dorsal dislocation of the ulna or more accurately the volar dislocation of the radius. However, the prominence can be difficult to identify in a swollen and contused forearm.

It is generally agreed that radial fracture in these injuries is distal as described by Galaezzi. However, Mikic [14] in his study, reported 43% cases of radial fracture, located in lower third of the radius. Disruption of triangular ligament complex seems certain if the ulnar styloid is fractured particularly at its base. As noted by Mikic [14] in 31% of his patients the distance between the articular surfaces of distal radioulnar joint is increased as demonstrated on an antero-posterior radiograph of the wrist. Apparent dislocation of ulnar head is variable on lateral radiograph only when the distal radioulnar joint is disrupted and is usually dorsal. Shortening of radius has been reported to indicate the rupture of triangular ligament.

As to the surgical line of management it should be treated by dynamic compression plating (Fig. 4A & B) by volar Henry's approach in lower third fractures or dorsal approach. The compression plate can be applied volarly in lower third fractures this is contrary to the principle of applying the plate to tension side of the bone, in this instance the dorsal of the radius. Since the soft tissue coverage on the volar surface is better and bone contour is flat it is easier to apply the plate here. Bone grafting can be done when there is gross bone loss and 4 weeks of immobilization in neutral position or mid supination is adequate. After ORIF resection of distal end of ulna or temporary fixation of distal radioulnar joint with a pin through the radius and ulna is not required, if ever required, after plating of an acute fracture.

Fig 4: A- Dynamic compression plate (DCP) insitu with plate holder, B- DCP with screws.

At the final evaluation the extent of rehabilitation of injured extremity was determined by interview and standard biplane radiographs. The range of motion was estimated. Dorsiflexion and volar flexion of wrist and pronation and supination of forearm were recorded but radial and ulnar deviation of wrist was not determined.

Movement of the digits, elbows and shoulder were evaluated only by gross inspection. Muscle strength was determined manually and sensation to light touch and pin prick was assessed in each patient. Radiographs were evaluated for healing of the fracture, alignment of the radius and reduction and congruity of the surfaces of distal radioulnar joint.

Complications

In this study, one case was presented two months after the trauma treated by bone centers and showed poor result. An open reduction with 6 hole dynamic compression plate (DCP) (Fig. 2A and B) supplemented by autogenous iliac cancellous bone graft was done, the fracture graded as non-union at 9 months follow up. Dorsiflexion is restricted completely, forearm supination and pronation was also restricted to more than 45°.

Immediate post-operative period in our series there was a complication of tourniquet palsy which recovered. Infection was seen in 2 cases and controlled with antibiotics. 6 cases were followed up to 1 year and the remaining cases up to 6 months with no complications.

Conclusion

Galaezzi fracture is uncommon in children compared to adults. This lesion appears to be undiagnosed in routine orthopaedic clinics. Indirect force is the most common type of mechanism. It occurs mostly in young adults, predominantly in males. As revealed by the present study, this is the combination of fracture radius with inferior radioulnar joint dislocation. As the X-ray shows fracture radius in lower third of middle third without obvious dislocation of ulnar head should be taken as Galaezzi fracture should be the reduction of ulna is obtained while taking radiographs.

As universally accepted open reduction and internal fixation should be the treatment of choice in adults, close reduction advocated in children. Though the conservative line of treatment and malunion are accepted by few, full function will not occur in conservative line of management.

References

1. Galeazzi R. Di una particolare sindrome traumatica dello scheleto dell'avambraccio. AttiMem Soc Lombardi Chir. 1934; 2:12.
2. Clare DJ, Corley FG, Wirth MA. Ipsilateral combination monteggia and galeazzi injuries in an adult patient: A case report. J Orthop Trauma. 2002; 16:130-134.
3. Jafari D, Taheri H, Shariatzade H, Mazhar FN, Jalili A, Ghahramani MH. Bilateral combined Monteggia and Galeazzi fractures: A case report. Med J Islam Repub Iran. 2012; 26:41-44.
4. Giannoulis FS, Sotereanos DG. Galeazzi fractures and dislocations. Hand Clin. 2007; 23:153-163.
5. Vesely DG. The distal radio-ulnar joint. Clin Orthop Relat Res. 1967; 51:75-91.
6. Campbell. Campbell's operative Orthopaedics. Frederick MA, Terry CS, James HB. 8th Ed. Internat Edition. Elsevier Publ. 1941.
7. Eberl R, Singer G, Schalamon J, Petnehazy T, Hoellwarth ME. Galeazzi lesions in children and adolescents: treatment and outcome. Clin Orthop Relat Res. 2008; 466:1705-1709.
8. Hughston JC. Fracture of distal radial shaft: Mistakes in management. J Bone Joint Surg Am. 1957; 39:249-264.
9. Wei SY, Born CT, Abene A. Diaphyseal forearm fractures treated with and without bone graft. J Trauma. 1999; 46(6):1045-1048.
10. Reckling FW. Unstable fracture dislocations of forearm (Monteggia and Galeazzi lesions). J Bone Joint Surg Am. 1982; 64:857-863.
11. Moore TM, Klein JP, Patzakis MJ, Harvey P. Results of compression plating in closed Galeazzi fractures. J Bone Joint Surg Am. 1985; 67:1015-1021.
12. Solomon L, Warwick DJ, Nayagam S. Appley's System of Orthopaedics and Fractures (8th edtn). Oxford University Press Inc. New York. 2001.
13. Dewo P, Yudhistira JF, Lanodiyu Z, Magetsari R.

Functional Outcome of Galeazzi Fractures Treated by ORIF and DRUJ Stabilization either Using Long Arm Cast or Transfixing Wire. Orthopedic & Muscular System: Current Research. 2015.
14. Mikic ZD. Galeazzi fracture dislocations. J Bone Joint Surg Am. 1985; 57:1071-1080.
15. Chattopadhyay A, Chatterjee ML. Recognition of two types of Galaezzi fracture-dislocation and their management. J. Indan Med. Assoc. 1986; 84(10):307-308.
16. Dodge HS, Cady GW. Treatment of fractures of the radius and ulna with compression plates: A retrospective study of one hundred and nineteen fractures in Seventy-eight Patients. J Bone and Joint Surg Am. 1972; 54:1167-1176.
17. Strehle J, Gerber C. Distal radioulnar joint function after Galeazzi fracture-dislocations treated by open reduction and internal plate fixation. Clin Orthop Relat Res. 1993; 293:240-245.
18. Mohan K, Gupta AK, Sharma J, Singh AK, Jain AK. Internal fixation in 50 cases of Galeazzi fracture. Acta Orthop. 1988; 59:318-320.